## Oakley Sound Systems

# Euro Rack Series

# Classic VCA

## Discrete Core Voltage Controlled Amplifier

# User Manual

## V2.2

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# Introduction

This is the User Manual for the Classic VCA 3U module from Oakley Sound. This document contains an overview of the operation of the unit and the calibration procedure

For the Builder's Guide, which contains a basic introduction to the board, a full parts list for the components needed to populate the board or boards, and a list of the various interconnections, please visit the main project webpage at:

http://www.oakleysound.com/vinvca.htm

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

For general information on how to build our modules, including circuit board population, mounting front panel components and making up board interconnects please see our generic Construction Guide at the project webpage or http://www.oakleysound.com/construct.pdf.

*The prototype Classic VCA module using a 10HP wide Scheaffer panel. Note that on this module the sockets are on the right of the pots. The Krisp1 manufactured version has the pots to the left and fitted with an 8HP wide panel. The functionality is the same however.*

# The Oakley Classic VCA

This is a vintage voltage controlled amplifier design. It is based on the classic ARP4019 sub-module which was used on the wooden case ARP2600P semi-modular synthesiser. The design has a fully discrete core but uses a single high quality audio op-amp for output amplification.

The unit features both linear and exponential control voltage (CV) inputs. Both can be used together or individually.

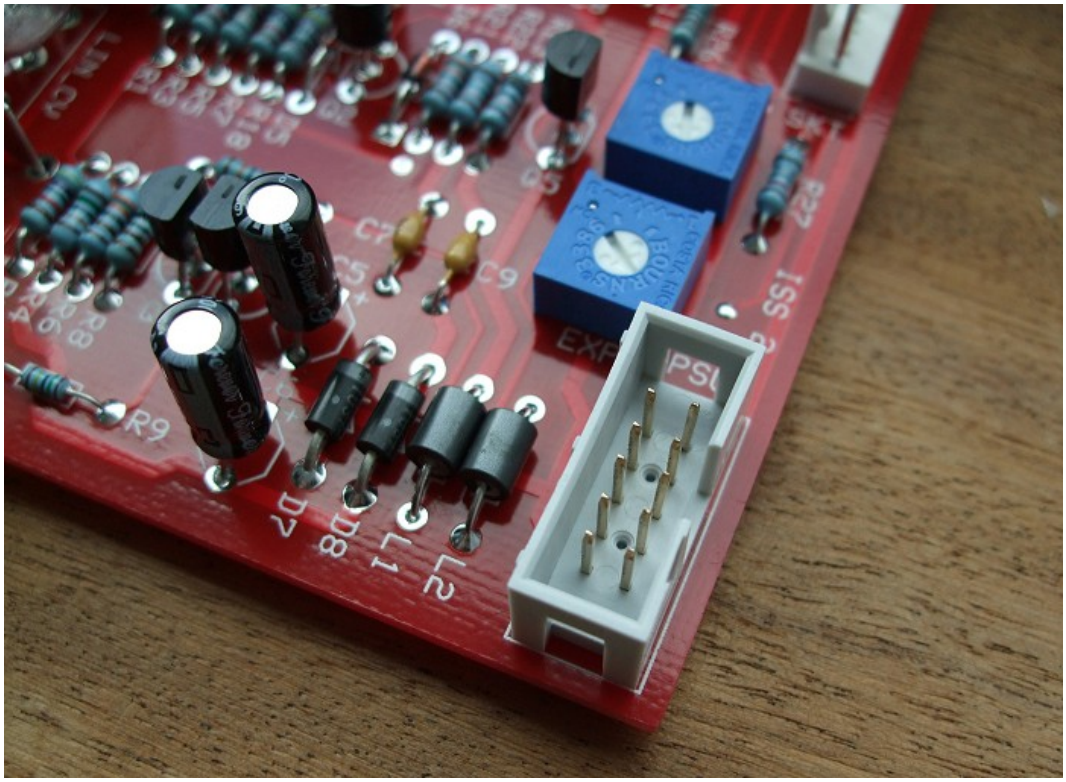
Two signal inputs are provided, one DC coupled and the other AC coupled. The former allows audio and low frequency signals to be processed. While the latter provides a DC block to process only alternating frequencies. Both inputs can be used simultaneously and each one features an input level control.

A gain control is also available to provide a fixed bias to set the initial gain of the VCA. This way a negatively going CV can reduce the overall gain of the VCA. The gain pot can also be used a volume control.

# Power Supply

This module is designed to run from a plus and minus 12V supply. These should be adequately regulated. The current consumption is about 20 mA per rail.

The power header is labelled PSU on the circuit board and is a standard 10 pin Doepfer style power supply connection. This is a 2 x 5 0.1” header and will fit 0.1” flat ribbon IDC sockets. The board should have been fitted with a box polarised header. This stops the cable from being plugged into the module the wrong way around.




The -12V connection follows the convention set by Doepfer and is at the bottom corner of the main circuit board. The -12V connection is usually depicted by a red stripe on the cable. Thus the red stripe should be fitted so that it goes to the bottom of the module.

Do not connect your VCA module to your modular's power buss without switching your whole modular off first.

The issue 2 Oakley Classic VCA does have reverse polarity protection up to a point. It achieves protection by shorting out the power supply if the power is reversed. The power supply should switch off when this happens thus protecting both the module and the power supply. If you connect the Oakley VCA to your modular and the modular will then not boot up properly the chances are that you have reversed the cable. Quickly switch off the modular and check the cable polarity.

The old issue 1 Classic VCA features no power supply protection. Take extra care in ensuring that the -12V supply connects to the bottom of the header. Failure to do so will damage the module.

# Using the Classic VCA

**What is a VCA?**

The VCA (Voltage controlled Amplifier) is a device used to control the level of one signal by the application of another. Traditionally, the *controlled* input to the VCA is called the INPUT, whilst the *controller* input is called the CV, or control voltage. A typical system will have the input as the audio output from a filter or oscillator, and the CV from an envelope generator. As the envelope generator's output voltage rises and falls, so the output of the VCA becomes louder and softer. The output of the VCA is connected to the OUT A socket on the module.

It should be noted though that the CV input can actually be an audio input, and that the INPUT can be a control voltage. It is up to you what you put into the module. The nomenclature refers only to the original and common usage of the input sockets on a VCA module.

The term *amplifier* is actually slightly different to the one you normally use too. It doesn't always amplify in so far as it doesn't normally make the input signal bigger. The amplification, or gain, actually varies from nearly zero, ie. the VCA is closed or off, to about one, or 0dB. When the gain is one then the output level is the same as the input voltage.

**The Oakley Classic VCA**

The Oakley Classic VCA features two input signals, IN1 (DC) and IN2 (AC), and each has its own level control. In this way, the Classic VCA can be used to mix or sum two signals together before they are processed by the VCA core. One of the inputs, IN1 (DC), is directly coupled to the VCA core. All signals, CV and audio, connected to this input can therefore be controlled by the VCA. The other input, IN2 (AC), goes via a capacitor and so is often called 'AC coupled'. The capacitor acts to block very low frequency signals and steady state voltages. You can think of it as being a high pass filter with a very low cut-off frequency.

The GAIN pot controls the 'initial gain' of the module. This is used to partially open the VCA, even when there are no other signals applied to either of the two CV inputs. If any positive CV is applied then this will open the VCA further. While the addition of a negative CV will actually cause the VCA to close.

Two control voltage inputs are provided, LIN CV and EXP CV. Each has its own level pot which controls the depth of the effect.

The LIN CV input has a linear response. This means that doubling the CV will double the output amplitude. In general this is the most useful response for general VCA duties. With the gain pot at its minimum, and the LIN CV pot at its maximum, +5V at the LIN CV input will produce a gain of around one.

The EXP CV input has an exponential response. This means that a rising CV will produce a proportional change in gain measured in decibels. In practice this means that the output signal appears not to quickly increase in level until the input CV is close to 5V. This affect tends to produce wonderfully plucky sounds when used with a conventional ADSR as the CV source.

# Trimmers

There are three trimmers on the issue 2 PCB which need adjusting correctly to get the best out of the VCA module. It is beneficial to adjust these in your own modular as the settings are affected slightly by the power supply voltages.

Allow the modular and VCA module to warm up for at least 15 minutes.

**OFFSET:** Turn the GAIN pot to its maximum level. Ensure all other pots are at their minimum settings. Measure the output voltage from the output socket with a good digital voltmeter. Adjust OFFSET with a jeweller's screwdriver or equivalent until the output voltage is 0.000V +/- 5mV.

**LIN:** Insert a 5V peak triangle wave signal at roughly 440Hz to the INPUT(AC) input. Turn the GAIN and the INPUT(AC) pots to their maximum. All other pots should be at their minimum settings.

Now with a scope measure the output voltage and adjust LIN until the input and output signals are the same level. It doesn't have to be that accurate – within 250mV will be fine.

If you do not have a scope, all you need to do is compare the input signal to the output signal. Adjust LIN until the two signals are the same volume. The best way to do this is to use a multiple. Connect the triangle wave from your VCO to the multiple, and then with another cable into the VCA input as above. Connect up your monitoring system to the same multiple and adjust your monitoring volume to suit. Then simply swap the monitoring system's jack plug from the mult to the VCA's output and adjust LIN accordingly. It doesn't have to be that accurate, just try to get the two signals sounding roughly the same.

**EXP:** Insert a 5V peak triangle wave signal at roughly 440Hz to the INPUT(AC) input. Turn the INPUT(AC) and EXPO CV pots to their maximum. All other pots, including the GAIN pot, should be at their minimum settings. Connect a 5V source to the EXPO CV input. This could be a fixed voltage source, a triggered envelope generator or midi-CV convertor – anything that will give you a +5V output signal.

Now with a scope measure the output voltage and adjust EXP until the input and output signals are the same level. Again it doesn't have to be that accurate – within 250mV will be fine.

Likewise, if you do not have a scope then repeat the same procedure as the LIN trimmer, but this time adjust EXP to ensure that input and output are the same volume.

If you have an issue 1 board you will have one additional trimmer to set. The NULL trimmer is designed to reduce audio breakthrough. Thus NULL needs to be adjusted so that any signal on the signal inputs are not passed onto the main VCA output when the VCA is off. However, the original ARP documentation says any trimming procedure is worthless and that the trimmer should be left as you find it. After various experiments I would have to agree with this for my version too. Therefore, I would recommend that it should be simply turned fully clockwise, ie. off.

# Final Comments

I hope you enjoy using the Oakley Classic VCA

If you have any problems with the module, an excellent source of support is the Oakley Sound Forum at Muffwiggler.com. Paul Darlow and I are on this group, as well as many other users and builders of Oakley modules.

If you have a comment about this user manual, or have a found a mistake in it, then please do let me know.

Last but not least, can I say a big thank you to all of you who helped and inspired me. Thanks especially to all those nice people on the Synth-diy and Analogue Heaven mailing lists and to those at Muffwiggler.com forum.

***Tony Allgood at Oakley Sound***

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